Disturbance and Invasive Species

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The connection between disturbance and invasive species likely will be a critical area of research for the unit in years to come. Kim Crider is currently working toward a Ph.D. at the University of Montana, looking at the effects of disturbance (fire and logging) and biological control agents on the population dynamics of an invasive plant (tansy ragwort, Senecio jacobaea). Tansy ragwort is native to Europe and Asia and is considered an invasive species in North America. It was first identified in the United States in Oregon in the early 1900s. Since this time, despite relatively successful control of the species in Oregon, tansy ragwort has spread eastward to Idaho and Montana. Tansy ragwort is known to compete with native plants and proliferate in areas with frequent disturbance. Additionally it is toxic to wildlife and livestock, and is thus of high concern in areas that are regularly grazed.

Tansy ragwort only recently has become a problem in Montana, first discovered in 1996 following the 1994 Little Wolf wildfire in the Little Wolf Creek drainage in Lincoln and Flathead Counties in northwest Montana. An aerial herbicide control program was immediately implemented, followed by the release of three biological control insects beginning in 1997 in Flathead National Forest (Flathead County), while populations in Kootenai National Forest (Lincoln County) were not as intensively managed. By 2000, managers reported a sharp decline in the infestation of tansy ragwort on Flathead National Forest, and control emphasis shifted to the Kootenai National Forest.

Biological control has been the main focus of management efforts in northwest Montana. The basic idea behind biological control is to introduce an insect known to control a plant in its native range to the plant's introduced (invasive) range in an attempt to control the species. Due to the ecological risks associated with introduced species in general, potential introduced biological control organisms must be rigorously tested to ensure they will have low impacts on native species but high impacts on the target invasive species. Although biological control has been effective in controlling invasive plants, there are very few documented cases of success. Too often, release and monitoring of the biological control agents themselves are the focus of research but effects on

their invasive targets are rarely documented. Furthermore, such effects are rarely quantified at the population level; damage to individual plants may be quantified but that gives little indication of the reduction to the invasive potential of the species at a larger scale.

Kim's research will quantify the effects of two biological control agents, the cinnabar moth and the ragwort flea beetle, on the population growth rate of tansy ragwort in areas with different disturbance histories. Managers in the area believe that the cinnabar moth plays an important role in controlling these tansy ragwort populations, but this observation has not been quantitatively verified. The project is designed to answer the following questions:

- Are biological control agents affecting growth and expansion of tansy ragwort populations?
- Are both biological control agents (insects) necessary, or would it be more economical to focus on the establishment of one or the other?
- What habitats are more likely to facilitate the growth and expansion of tansy ragwort populations in terms of prior disturbance such as harvest, wildfire, and grazing?
- How do biological controls differ in their impacts between these types of habitats?

Demography is one way to quantify the effects of biological control and habitat on plant populations, by following marked individual plants through their entire life cycle. This approach will give an idea of which life stages are most important to the plant's invasive potential. By combining rates of recruitment of seedlings, seed production, and juvenile rosette survival we can construct a life stage transition model to project population size and growth rate into the future under similar conditions. This approach is extremely useful for invasive species because it allows us to predict the potential "invasiveness" of a particular species in areas with and without biological control agents and in habitats with different disturbance history, allowing managers to better plan eradication strategies and management activities to

reduce or prevent the spread of particular species. At the completion of this work, Kim hopes to offer a management prescription for tansy ragwort in Montana, expand general ecological knowledge about plant-insect interactions and population dynamics in disturbed, non-native habitats, and bring needed skills back to the unit and Southern forest ecosystem studies.